

Jet Propulsion Laboratory, California Institute of Technology

# Altimetry Missions Applications Program Plan

Jason-2, Jason-3, Jason-CS/Sentinel-6, and other altimetry satellite missions



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## 1. PURPOSE

The purpose of this document is to establish guidelines and a framework for developing and implementing an Applications program for the currently operating and future ocean altimeter satellite missions, particularly those planned for operational mode. The near-term focus is on the Jason-series missions, with expanded attention planned for future and non-NASA missions as resources allow. Science objectives for the Jason-series ocean altimetry missions can be viewed at <https://sealevel.jpl.nasa.gov/science/scienceobjectives/>.

Satellite altimetry data have been used for applications purposes for decades. This Altimetry Missions Applications effort will engage known scientific and operational users of altimetry data to help identify existing and recruit new applied data users. A significant user community target includes decision makers who can and do benefit from data and information products derived from these missions. Thus, the Altimetry Missions Applications efforts will include developing and testing strategic ways to effectively transition individuals and groups from being “potential users” (i.e., Community of Potential<sup>1</sup>) to being “practitioners” (i.e., Community of Practice<sup>2</sup>).

This document is intended to provide guidance and outline existing and potential future activities, partners and communities. Activities will be focused on engaging, encouraging, and developing targeted user communities. This includes users who have a clear and well-defined need or use for mission data products, as well as groups that may be unfamiliar with NASA data and mission capabilities, but can benefit from the mission information and data products in their processes.

## 2. GOAL & OPERATING PRINCIPLES

The scope and goals of the efforts described in this document are derived, generally, from NASA mission Project resources. The focus of the discussion and the functional framework reflect this. However, the activities may be applicable and relevant to other partner and other international missions. This effort will incorporate any and all relevant missions as resources and participation from partnering organizations permits.

The primary goal and scope of this program is to maximize the benefit of NASA Earth Science Directorate (ESD) investments by enhancing the applications value and overall societal benefits of the reference missions. Similar importance of and focus on these benefits to NASA’s partnering agencies and missions is also a primary objective . The goals of this effort include the following:

- Identify existing applications, users, and use cases<sup>3</sup> of ocean surface topography (OST) information to better understand its impacts and societal benefit;
- Establish scope of existing applied research and develop new applications that support ocean altimetry mission concepts;

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<sup>1</sup> Participants who are familiar with NASA, currently use NASA products and have a clear, well-defined need for mission data products.

<sup>2</sup> Participants who are unfamiliar with NASA and NASA mission capabilities, but have the potential to benefit from the mission products in their applications.

<sup>3</sup> Use Cases serve as “example projects” that can demonstrate both applied science and societal impact. They can provide a qualitative assessment of the societal relevance of that science data on a decision process or policy.

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- Demonstrate the benefit of OST to society and contribution to the achievement of societal outcomes;
- Increase the utility of data products and facilitate the NASA Physical Oceanography Distributed Active Archive Center (PO.DAAC) and partner data services groups ([AVISO+](#), etc) in engaging the user community and in providing access to data products; and
- Foster the altimetry mission community of practice who will work with the applications program throughout the mission life cycles (e.g., engaging with the Sentinel-6A Community of Potential during its Phase B).

The operating principles for the Altimetry Missions Applications program are as follows:

- Partner with proven, effective organizations, groups, and/or individuals with aligned goals and objectives (Appendix A);
- Identify and develop specific target audiences and users;
- Provide inspiration, information, and capacity-building opportunities (Appendix B); and
- Employ a thematic framework based on past successes with application of data from current and previous altimetry missions (Appendix C).

The communication strategy for this program may include some of the elements listed here:

- Content aligned with and shared through NASA's social media efforts
- Easily discoverable online resources
  - One-page summaries of mission applications, including relevant references to published works
  - Video (i.e., data product tutorials, testimonials)
  - Use cases as example applications and societal benefits
- In-person and online events
  - Focus sessions at meetings and conferences
  - Workshops, tutorials and short courses

### 3. ACTIVITIES

This section will describe applications activities by project phase for the Jason-2 (J2), Jason-3 (J3) and Jason-CS/Sentinel-6 (S6) missions (as defined in the current version of NASA Procedural Requirements (NPR) 7120.5E). A description of project phase activities for future altimetry missions – i.e., those prior to Phase B in their development – do not appear here. Each phase described herein includes applications-relevant activities that are aligned with the maturity of the mission and its data products. For the Plan described here, S6 is in Phase B, while J2 and J3 are in Phase E. Deliverables by phase can be found in the table in Appendix D.

One activity will be development of an altimetry missions' applications traceability matrix (ATM), which identifies relationships between applications uses and associated measurements and data products. The ATM will articulate specific applications questions and concepts that can be answered and addressed by these missions. It will also include information on data products such as spatial resolutions, latencies, ancillary measurements, and on Application Readiness Levels (ARL), where available.

Another activity is the development of a user database. This is intended to identify the topical areas of practical uses of the data (again, not research, although some overlap is likely) and will identify categories of use, specific users, and economic and ancillary information, where available. This will be a ‘living document’, and will grow as the effort to identify the breadth of existing and new uses and users grows.

### 3.1 Phases C & D

**Purpose:** Keep the altimetry mission community of potential engaged. Use existing satellite mission data, resources, and training events to prepare users for new satellite mission data upon commencement of operations. Provide progress reports prior to the project’s Key Decision Point for Phase D (KDP-D) and Key Decision Point for Phase E (KDP-E).

**Focus:** Engage with a broad community of potential OST applications users. Communicate about existing OST applications resources, products, and outcomes. Create new resources (e.g., one-pagers, posters, data product tutorials) or products, as necessary. Support decision making related to altimetry-based information products.

**Implementation Activities:** Update, refine and develop new use cases to showcase benefits of OST data applications. In collaboration with the PO.DAAC and other data centers, establish the scope of OST data usage (e.g., TOPEX/Poseidon, Jason-1, J2, J3). Identify applications with high potential by analyzing publications in the OST literature database and conducting targeted (e.g., industry) surveys. Catalog existing and potential new altimetry-related information products aligned with needs of decision makers. Conduct a pilot orientation for key members of the altimetry mission community of practice (e.g., in conjunction with OST Science Team meetings) to support future applications of altimetry mission data. Include implementation progress of these efforts in standard mission and science activities and reporting.

### 3.2 Phase E Prime/Extended

**Purpose:** Promote and expand high-value applications of satellite altimetry data products. Document the societal impact of applications achieved during the operational phases of the altimetry missions. Provide progress reports prior to the project’s Key Decision Point for Phase F (KDP-F).

**Focus:** Build capacity of OST operational data users via training events and online resources. Expand the inventory of altimetry data resources and information. Document the societal impact of OST data applications.

**Implementation Activities:**

Expand online inventory of relevant resources and information. With key members of the OST community of practice (i.e., Steering Committee), formulate a “road map” for development of future products and training events that are aligned with the established thematic framework (Appendix C). Plan and execute in-person and online events to showcase – and get feedback on – the effectiveness of use cases, applications resources,

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and data product tutorials. Expand the OST applications user base by conducting targeted events (e.g., workshops, short courses) for the community of potential; for example, at meetings attended by data users and their associated decision makers (e.g., annual Climate Prediction Applications Science Workshop, CPASW). Contact key partners to discuss mutually beneficial activities and products (e.g., NASA’s Applied Remote Sensing Training, ARSET; NASA’s Socio-Economic Data and Applications Center, SEDAC). Provide support to the ESD Senior Review requests.

### 4. SENIOR REVIEW

During the NASA Senior Review process for each mission (e.g., J2, J3, S6), the Altimetry Missions Applications team will work with Projects to document the societal benefits established through this plan and other activities. Evidence of impact will likely include use cases; user testimonials; survey results from workshops, short courses, and other community events; and literature review results (e.g., journal articles, popular press articles, etc.).

### 5. SCHEDULE

The schedule below depicts a notional milestones plan. More details will be included in updated versions of this plan.

	FY 2018			FY 2019				FY 2020				FY 2021				
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
<b>Altimetry Appl. Plan</b>																
<b>Appl Traceability Matrix</b>																
<b>List of Contacts</b>																
<b>Community of Practice</b>																
Steering Group Meetings																
Activities @ OST Meetings																
<b>Community of Potential</b>																
Workshops (in-person)																
Short Courses (online)																
<b>Resources</b>																
Inventory & Updates																
Use Cases																
Data Product Tutorials																
<b>Document Impact</b>																
		Initial delivery or event date						Ongoing updated								

## APPENDIX A: List of Partners

The following is a list of potential partners who have a demonstrated interest in satellite altimetry applications. Over time, this altimetry missions applications program will endeavor to grow its partnerships with effective organizations, groups, and/or individuals with aligned goals and objectives. ***(This is a notional list of possible partnering organizations and does not imply any commitment or allocation of resources by these organizations.)***

### NASA

- Science Mission Directorate (SMD)
- Applied Science Program (ASP)
- Ocean Surface Topography Science Team (OSTST, *a joint program of NOAA, CNES and NASA*)
- Applied Remote Sensing Training (ARSET) Program
- Physical Oceanography Distributed Active Archive Center (PO.DAAC)
- Socioeconomic Data and Applications Center (SEDAC)

### National Oceanic and Atmospheric Administration (NOAA)

### Centre National d'Etudes Spatiales (CNES)

- AVISO+
- Collecte Localisation Satellites (CLS)

### European Organization for Meteorological Satellites (EUMETSAT)

### Commonwealth Scientific and Industrial Research Organisation (CSIRO)

### Ocean Observing Systems

- Global Ocean Observing System (GOOS)
- U.S. Integrated Ocean Observing System (IOOS)

## **APPENDIX B: Capacity-Building Resources and Events**

The Altimetry Missions Applications Program is designed to create resources and conduct various types of events to provide inspiration and information, and to build capacity. These activities will engage a wide spectrum of practicing and potential users of altimetry data. Feedback and guidance collected during these events will be captured and, when applicable, used to update the program objectives and goals.

### **Workshops**

Workshops will provide hands-on instruction for locating and manipulating altimetry data and products. These will likely be a collaborative effort between the mission science assets and application teams, as well as the PO.DAAC and other data centers. The objectives will be to familiarize participants with data structures, lessons learned from the satellite altimetry community of practice, and PO.DAAC's distribution and user services.

### **Short Courses**

Short courses provide hands-on instruction for where to find and how to manipulate OST data and products. Planned and executed in collaboration with the PO.DAAC, these events will provide practical information for potential data users. There will be a focus on developing professional skills including data discovery, access, and visualization techniques. These events will also provide opportunities to elicit feedback on PO.DAAC user services and online tools.

### **Data Product Tutorials**

Highly complementary to in-person and online training, data product tutorial videos will be created. These easily discoverable resources will aid potential users of satellite altimetry data and nominally be available from the PO.DAAC and its YouTube channel. Several such tutorials were generated for the online short course, *Aquarius Data Visualization, Interpretation, Communication & Engagement*. Since June 2016, each of these videos has been viewed over 1,100 times on the PO.DAAC Forum ([podaac.jpl.nasa.gov/forum/viewforum.php?f=64](http://podaac.jpl.nasa.gov/forum/viewforum.php?f=64)).

## APPENDIX C: Thematic Framework

The Altimetry Missions Applications effort will employ a thematic framework based on past successes with application of data from current and previous altimetry missions. The framework below is based on content from the “Ocean Surface Topography From Space” (<https://sealevel.jpl.nasa.gov/science/societalbenefits/>) website, NOAA-produced altimetry applications document, and other relevant themes (e.g., land-based surface water levels).

<b>Weather</b>	<b>Climate</b>
Hurricane forecasting	Global/regional sea level rise
High wave warnings	Ocean warming
El Niño / La Niña seasonal forecasting	Pacific Decadal Oscillation
<b>Ocean Health</b>	<b>Land-based Operations</b>
Fisheries & trust species management	Inland waters
Ocean hypoxia “dead zones”	Reservoirs
<b>Coastal Communities &amp; Economies</b>	Lakes
Search and rescue	Large rivers
Off-shore operations	<b>Other Societal Benefits</b>
Oil spill response	Marine research
Global/regional sea level rise	Education
Fisheries services	Insurance
Energy siting purposes	

## APPENDIX D: Products by Mission Development Phase

	Phase B	Phases C & D	Phase E
<b>Project Life Cycle</b>	Preliminary Design and Technology Completion	Final Design, Fabrication, Systems Assembly, Test and Launch	Operations and Sustainment
<b>Purpose</b>	Implement the Altimetry Missions Program Applications Plan and build the applications user base	Engage communities, effectively communicate applications benefits, and support decision making	Promote / expand high-value applications and document societal impacts of operational missions
<b>Activities</b>	Inventory existing OST applications resources	Expand OST applications resource inventory	Expand OST applications resource inventory
	Identify potential Use Cases	Develop use cases and new resources (as needed)	Develop use cases and new resources (as needed)
	Align Use Cases and other resources with thematic framework and SDGs	Establish scope of OST data usage	Formulate "road map" with key members of the community of practice
	Develop Community Contact List	Identify high-potential applications from literature and via surveys	Conduct online (ARSET) and in-person (e.g., CPSAW) training events
		Catalog information products needed by decision makers	Disseminate data product Tutorials in collaboration with PO.DAAC
		Engage key members of J2/J3 Community of Practice	Document societal impact of OST data applications
<b>Deliverables</b>	Altimetry Missions Program Applications Plan	Updated Plan (annual) and ATM (as needed)	Updated Plan (annual) and ATM (as needed)
	Applications Traceability Matrix (ATM)	Use cases and other resources	Applications workshop(s) and short course(s)
	Community Contact List	Applications workshop(s)	Information for Senior Review submissions
<b>Mission Events</b>	PDR: Preliminary Design Review	CDR: Critical Design Review	Commissioning
		SIR: Systems Integration Review	Operational data availability
		ORR: Operations Readiness Review	
		MRR: Mission Readiness Review	
<b>Gate Reviews</b>	KDP-C	KDP-D/KDP-E	KDP-F